Department of Primary Industries
Department of Regional NSW

# Aphid management in pulse crops

## Key points

- Correct aphid identification is critical as species differ widely in their ability to transmit viruses and the methods to control them.
- Aphid numbers fluctuate depending on the host availability, environmental conditions and the presence of beneficial insects.
- Early seasonal build-up of aphid populations determines the risk level for the season.
- A few aphids can cause substantial damage by spreading viruses, especially early in the season, but it takes large numbers of aphids to damage crops through direct feeding of the plants.
- Pulse crops are far more vulnerable to virus infection than cereal crops.
- All major crop viruses require an insect vector (mostly aphids) for plant transmission. There are a small number of viruses that can be transmitted via seed such as *Cucumber mosaic virus* (CMV) in lupins.
- The faba bean aphid was recorded for the first time in 2016 in Australia, in 2020 in commercial faba bean crops in northern NSW and in Queensland in 2021. Faba bean aphid is a potential vector of *Bean leafroll virus* (BLRV) in faba bean.
- Seed dressings cannot prevent aphid migration but can slow the growth of aphid populations early in the crop's life, slowing down the spread of viruses.
- Insecticides can be used effectively in-crop, however growers should be aware of increasing insecticide resistance in green peach aphid and blue green aphid and the need to use insecticides that are soft on beneficial insects.

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## Why aphids can be a problem

### Direct damage

Aphids can cause damage by direct plant feeding and can reduce crop yield if they are not controlled. The level of damage depends on the aphid species, the host plants sensitivity, growth stage and environmental conditions. Plants often express symptoms in the presence of aphids such as yellowing of leaf veins, leaf curling or distortion, wilting and senescence.

### Virus transmission

All of the major viruses in pulses need an insect vector, mainly aphids, to transmit viruses between plants. The exception is CMV in narrow leaf lupins that can be seed borne.

### Honeydew

Some aphids produce large amounts of honeydew when colonies are formed. It is a sugary liquid that covers plants, affects transpiration and attracts a fungus called sooty mould. The accumulated honeydew and fungus cause the plants to become sticky and dark. Harvest can be more difficult when high levels of honeydew are on a crop. The honeydew attracts different insects including ants which can be the first sign of aphid presence in a crop.

### Lifecycle

Aphids can have multiple, overlapping generations per year. They reproduce asexually, without mating, and lay live nymphs. Nymphs molt about 4 times and form winged (alate) or wingless (apterous) aphids.

An early autumn break, along with summer rainfall, favour early aphid numbers on host weeds or volunteer crops. Aphid migration starts in autumn when winged aphids fly into crop edges. They can start colonies of wingless aphids, which can then persist over winter. Crops should be monitored and aphids controlled during this time if numbers are high to prevent possible virus outbreaks later in the season.

Cold winter conditions slow reproduction until spring when reproduction is rapid, leading to population outbreaks. Aphid activity peaks in early spring.

### How to monitor for aphids

Scouting for in-crop aphids should be done regularly to see if numbers are building up and control is needed. It is important to monitor for beneficial insect numbers and activity before control decisions are made. Monitoring is best practiced in early established crops in autumn. This can be done by using sticky traps (Figure 1) or crop sampling. Sample plants for presence or absence at 5 points across a field with at least 20 plants sampled at each point. Monitor regularly as numbers can build rapidly within weeks. Aphids can form dense colonies on individual plants before moving onto surrounding plants showing up in patches or 'hotspots' within paddocks.

Damage will typically first appear on crop edges, so monitor these areas carefully. Inspect the underside of leaves and the new growth, including flower buds, as this is where the aphids will colonise.

### Role of beneficial insects

It is also important to monitor the populations and diversity of beneficial insects, including hover flies, lacewings, ladybirds and parasitic wasps (Figure 2). These insects can offer biological control for moderate aphid numbers and keep them under economically damaging levels, in some cases making chemical control not necessary. These beneficial insects can help reduce the spread of viruses and feeding damage, but some virus spread will have occurred before aphid numbers subside.

Figure 1 Sticky trap used for aphid monitoring

Figure 2 Mummified cowpea aphid on faba bean seedlings.

## Aphid species

### Pea aphid (*Acyrthosiphon pisum*)

- Pea aphid infests legumes including faba beans, field peas, and lentils.
- They can be found on growing tips, leaves, stems, flowers, and pods.
- They can cause leaf deformation and curling, wilting and yellowing, stunting, leaf drop and can reduced dry matter.
- The aphid's defence mechanism is to drop from the plant when disturbed.
- Pea aphid usually has a bright green body (Figure 3, left), red eyes, dark knee joints and dark bands on antennal segments. It is relatively large compared to other aphid species, with a body of up to 4 mm. Their nymphs (Figure 3, right) look similar to adults but smaller in size.
- Pea aphid is the main vector for the spread of BLRV, *Alfalfa mosaic virus* (AMV) and CMV, major viruses affecting chickpea and faba bean.

#### Economic thresholds (available data)

- Lupins:
  - WA: If more than 30% of growing tips are infested with clusters of 30 or more aphids.
  - NSW: Treat at appearance of clusters on flowering plants.
- Faba bean:
  - VIC: 10% of plants infested.

Figure 3 Left: pea aphid on field pea (adults and nymphs); right: close up of pea aphid adult and nymph.

### Cowpea aphid (*Aphis craccivora*)

- The cowpea aphid feeds on legumes including faba bean, lucerne, vetch, lentil and medic.
- They are often the first aphid species found on early emerged faba bean crops in autumn with the infestation starting from the growing tips.
- Damage includes yellowing or whitening of leaf veins. Well-developed colonies cause feeding damage that affect plant growth, causing rapid wilting and in some cases, plant death.

- Cowpea aphid can secrete high levels of honeydew which encourages the growth of sooty moulds.
- Adult cowpea aphid are roughly 2 mm in size and have a distinguishable dark brown to black shiny body with white and black legs and antennae that are white with black tips (Figure 4).
- The nymphs are not shiny and have a body colour that varies from grey to brown.
- The cowpea aphid is main vector of *Bean yellow mosaic virus*, CMV, AMV.

Figure 4 Cowpea aphid (adult and nymphs)

### Economic thresholds (available data)

- Lupins:
  - NSW: Treat at first sign of virus infected plants or appearance of aphid clusters on flowering spikes.
  - WA: >30% of inflorescences infested with 30 or more aphids.
- Chickpeas:
  - NSW: No threshold established.
- Faba beans:
  - NSW: Treat low levels of aphids to prevent virus transmission early in the season.

## Green peach aphid (*Myzus persicae*)

- Green peach aphid feeds on pulses, canola and other cruciferous weeds and crops.
- The whole plant can be infested, but most often colonies are found on the underside of lower leaves.
- They can cause leaf distortion, wilting and yellowing and leaf senescence. Heavy infestations can cause damage to plants by direct removal of nutrients.
- Green peach aphid are most common in spring, but are also active in autumn and winter.
- Adult green peach aphid (Figure 5) are 3 mm long and can vary in colour from pale green to yellow and pink. Winged adults have a dark patch on their abdomen, which is not present on wingless forms.
- Nymphs are pale green and smaller in size than the adults.
- They can transmit severe viruses including *Turnip yellow virus complex* (TuYV, formerly known as *Beet western yellows virus*) and CMV.

Figure 5 Green peach aphid (adults and nymphs)

### Economic thresholds

- Economic thresholds for green peach aphid have not been established.

## Blue green aphid (*Acyrthosiphon kondoi)*

- The hosts  of blue green aphid include lucerne, clover, lupin and lentil.
- Colonies are usually evenly spread across the host crop. Blue green aphid infests growing tips and causes damage such as yellowing and wilting, deforming leaves and causing plants to wilt.
- This species is morphologically similar to the closely related pea aphid, but the blue green aphid is smaller (up to 3 mm long), has a waxy appearance with a blue-green body, and antennae that gradually darken from base to the tip (Figure 6).
- Blue green aphid nymphs look similar to adults, but smaller.
- Blue green aphid are responsible for transmission of CMV and BYMV.

Figure 6 Blue green aphid adult

### Economic thresholds (available data)

- Lupins:
  - NSW: Treat at first indication of virus infected plants, or first appearance of aphid clusters on flowering spikes.
  - WA: >30% of inflorescences infested with 30 or more aphids, take into account the aphid tolerance of the variety.
- Faba beans: (Vic): 10% of plants infested.
- Lucerne, chickpeas and lentils: No thresholds available.

## Faba bean aphid (*Megoura crassicauda*)

- Faba bean aphid is a new threat to the Australian legume industry. Faba bean aphid was first recorded in north-west NSW in 2017 and was present again in 2020, 2021 and 2022 in multiple sites further north and west, including commercially grown faba bean. It was detected in Queensland in 2021. In 2022, faba bean aphid has been detected in central west New South Wales, the Riverina and Victoria. It appears the pest has spread quickly and has now become established across much of NSW.
- The faba bean aphid feeds mainly on faba bean and vetch, but it can survive on field pea, lentil, sub clover and lucerne. Chickpeas and lupins do not appear to be hosts.
- It is a large aphid whose body length exceeds 3 mm. The adult has a green body with dark head, antennae, legs, and patches on the abdomen. The most distinguishing feature of faba bean aphid is the intense red eyes (Figure 7, right).
- Nymphs are similar to adults but lighter coloured.
- Faba bean aphid multiplies extremely quickly and can transmit BLRV.

### Economic thresholds

- Economic thresholds for faba bean aphid have not been established.

Figure 7 Faba bean aphid adult and nymphs (left) and winged adult (right), note red eyes.

## Aphid and virus transmission

### Facts about viruses

Viruses can cause significant economic loss in pulse and other winter crops, especially when extensive infection occurs during early crop growth. There are two ways that viruses can be transmitted from plant to plant.

### Persistent transmission

Persistent transmission of viruses requires the aphid to feed on infected plants, acquire the virus and process it in its salivary glands for transmission to other plants (Figure 8). This process takes more than a day and results in **the aphid being infectious for the rest of its life.** Persistently transmitted viruses include BLRV and TuYV (Table 1).

Figure 8 *Bean Leaf Roll Virus* in faba bean.

### Non-persistent transmission

Non-persistent transmission of viruses occurs when an aphid acquires the virus through a short probing of an infected plant and transmit it immediately afterwards when probing a healthy plant. **The aphid loses the virus after few probes**. Non-persistently transmitted viruses include BYMV, CMV and AMV (Table 1).

Table 1 Viruses of pulse crops and methods of spread

| Crop | Virus | Abbreviation | Vector | Persistent | Non-persistent |
|---|---|---|---|---|---|
| Chickpeas | *Turnip yellow virus complex* (formerly known as *Beet western yellows virus*) | TuYV | Green peach aphid | Yes | |
| | *Cucumber mosaic virus* | CMV | Multiple species | | Yes |
| | *Alfalfa mosaic virus* | AMV | Multiple species | | Yes |
| | *Bean leafroll virus* | BLRV | Pea aphid, cowpea aphid, faba bean aphid | Yes | |
| | *Phasey bean mild yellows virus* | PbMYV | Cowpea aphid | Yes | |
| Lupins | *Bean yellow mosaic virus* | BYMV | Multiple species | | Yes |
| | *Alfalfa mosaic virus* | AMV | Multiple species | | Yes |
| | *Bean leafroll virus* | BLRV | Pea aphid, cowpea aphid | Yes | |
| | *Cucumber mosaic virus* | CMV | Multiple species | | Yes |
| Faba bean | *Bean leafroll virus* | BLRV | Pea aphid, cowpea aphid | Yes | |
| | *Bean yellow mosaic virus* | BYMV | Multiple species | | Yes |
| | *Turnip yellow virus complex* (formerly known as *Beet western yellows virus*) | TuYV | Green peach aphid | Yes | |
| Lentils | *Bean yellow mosaic virus* | *BYMV* | Multiple species | | Yes |
| | *Alfalfa mosaic virus* | *AMV* | Multiple species | | Yes |
| | *Bean leafroll virus* | *BLRV* | Pea aphid, cowpea aphid | Yes | |
| | *Cucumber mosaic virus* | *CMV* | Multiple species | | Yes |
| | *Turnip yellow virus complex* (formerly known as *Beet western yellows virus*) | *TuYV* | Green peach aphid | Yes | |

## Before you sow – management options

### Green bridge and alternative hosts

Aphids rely on the availability of a 'green bridge' for survival over summer. As these plants hay off or die, the aphids move into adjacent plants or crops which offer a more appealing food source. Summer hosts include pasture legumes, such as lucerne, along with volunteer crops and some weed species.

It is important to manage weeds and remove potential host plant sources from neighbouring paddocks to prevent the spread of viruses.

### Non-chemical controls

- Practice early sowing, using good quality seed as early plant vigour will help establish ground cover quickly which will deter the landing of migrating aphids.
- Consider planting in standing stubble rather than into bare ground. The lack of standing stubble could result in higher aphid landing rates, followed by early infestation and virus spread.
- Sow virus free seed if growing a pulse crop if the virus is seed borne (such as CMV in narrow leaf lupins).

Some varieties have virus resistance; refer to the Winter crop variety sowing guide 2022 for more information.

### Seed dressings

Imidacloprid seed dressing can be used to control early aphid infestations. These seed dressings are slow-acting, systemic insecticides that can reduce aphid numbers

in the crop and likely delay the colonisation of aphids during early plant growth. The treatment does not prevent aphid migration or aphid probing of treated plants.

Seed treatments are ineffective in preventing infection by non-persistently transmitted viruses but can aid in reducing the spread of non-persistently transmitted viruses in a crop.

### Insecticides

Foliar aphicide applications can be used in-season for control. Most aphid species, including the invasive faba bean aphid, can be controlled with pirimicarb. Insecticides should be applied according to the label and should consider the presence of beneficial insects. Repeated usage of the same chemicals should be avoided in order to prevent insecticide resistance. The green peach aphid has developed various levels of resistance to a wide range of commonly used insecticides (pyrethroids, carbamates, organophosphates and neonicotinoids). Emerging resistance of the blue green aphid to omethoate, chlorpyrifos and pirimicarb has also been recently found.

For more information regarding registered chemicals, rates and withholding periods, head to Insect and mite control in field crops 2022.

## Latest research on aphid monitoring

An aphid monitoring program was initiated in 2018 in northern NSW by NSW DPI with GRDC funding. Yellow sticky traps were used to capture incoming winged aphids in commercial pulse crops.

The level of aphids and viruses in pulse crops was low in 2018, likely reflecting the very dry conditions that year. In the following year, 2019, numbers initially increased but later dropped due to extreme drought conditions forcing crops into an early maturity. These conditions also encouraged the reproduction of beneficial insects which helped control aphid numbers.

In contrast, 2020 recorded extremely high incidents of BYMV, then AMV in faba bean crops. It is likely that late summer rains triggered native legume pasture germination and growth in lucerne, which encouraged aphid reproduction. Trapping data in lucerne showed an early peak in numbers in mid-April and May (Figure 9), with aphids moving onto faba bean early in the season resulting in virus transmission.

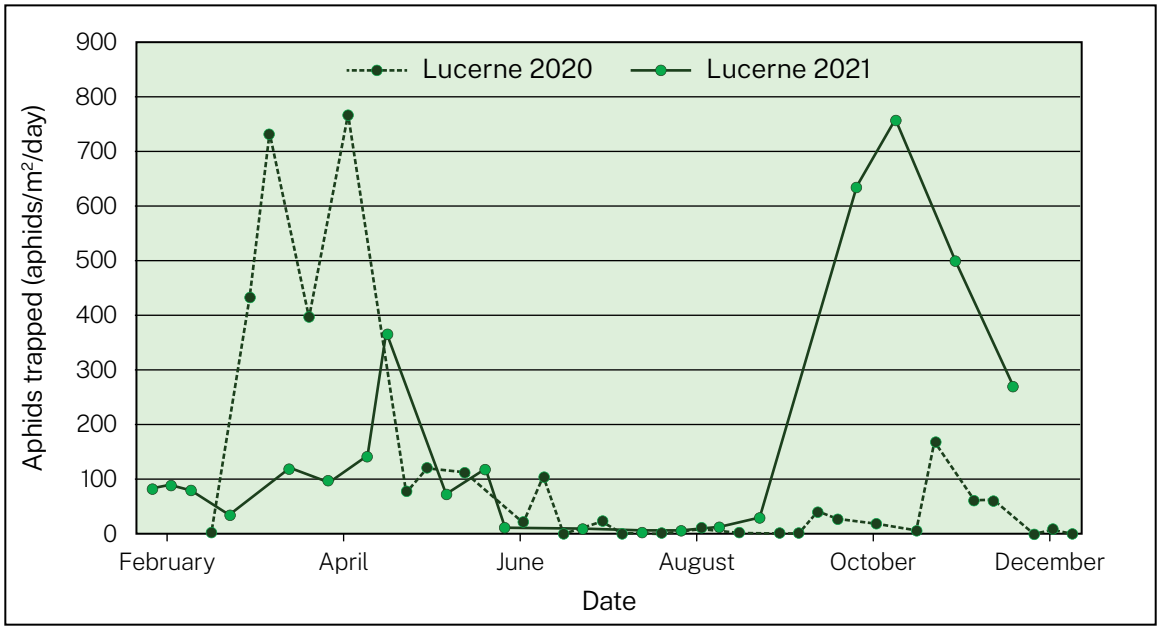


Figure 9 Aphid numbers on yellow sticky traps in lucerne in 2020 and 2021.

An opposite trend to 2020 was observed in 2021 with low aphid numbers recorded (Figure 9). There was a short peak in mid-May after which numbers remained low until mid-October. This was likely due to environmental conditions of cooler temperatures

and above average rainfall. Accordingly, the presence of viruses was low in pulse samples collected from several monitoring sites in autumn and later in spring 2021.

Environmental conditions such as temperature, rainfall, moisture and wind direction affect aphid migrations and while factors that affect aphid migrations cannot be controlled, they may be predicted. Future work needs to be conducted into studying aphid flights and migration. These results could be included in spatially explicit simulation models, which could assist in predicting aphid flights and therefore virus management strategies.

## Other resources

Insect and mite control in field crops 2022 (nsw.gov.au)

Managing viruses in pulse crops in 2021 (nsw.gov.au)

Crop aphids back pocket guide (2018, GRDC)

Beneficials chemical toxicity table (2022, cesaraustralia.com)

Winter crop variety sowing guide 2022 (nsw.gov.au)

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